Saskatchewan Agriculture and Food

FARM FACTS

Guidelines for safe rates of fertilizer applied with the seed

Granular Nitrogen - Cereal Grains

The following are considered to be approximate safe rates of urea (46-0-0) N applications with the seed of cereal grains if seedbed soil moisture is good to excellent *(soil moisture at or near field capacity).*

All rates are in pounds actual N per acre (i.e. divide by 0.46 to get lbs. of 46-0-0 per acre)

Soil texture	1 inch spread [1] (Disc or knife) [2]			2 inch spread [1] (Spoon or hoe)			3 inch spread [1] (Sweep)		
	Row spacing			Row spacing			Row spacing		
	6"	9"	12"	6"	9"	12"	6"	9"	12"
	SBU [3]			SBU [3]			SBU [3]		
	17%	11%	8%	33%	22%	17%	50%	33%	25%
Light (sandy loam)	20	15	15	30	25	20	40	30	25
Medium (loam to clay loam)	30	25	20	40	35	30	50	40	35
Heavy (clay to heavy clay)	35	30	30	50	40	35	60	50	40

[1] *Width of spread* varies with air flow, soil type, moisture level, amount of residue and other soil conditions, so it must be checked under field conditions.

[2] Some openers give less than one inch spread.

[3] SBU (Seedbed Utilization) is the amount of the seedbed over which the fertilizer has been spread. Thus, it is a reflection of the relative concentration of fertilizer. SBU (per cent) is the width of spread divided by the row spacing multiplied by 100. For example, if the seeding implement has a six inch spacing and spreads the seed and fertilizer over two inches, the SBU would be (two divided by six, multiplied by 100 which equals) 33 per cent. The higher the SBU, the more fertilizer that can safely be applied with the seed. Although some openers will also spread the seed and fertilizer vertically, SBU does not take this into account since it is generally recommended that all seed be placed at an even depth for even germination and emergence.

Additional notes:

- Cereal grains are treated as a group. Oat is slightly more tolerant of seed placed N than barley which is slightly more tolerant than wheat.
- Ammonium nitrate (34-0-0) is less damaging to seed than urea (46-0-0). For cereal grains only, the suggested safe N rates can usually be increased by about 25 per cent when ammonium nitrate is used. This recommendation should be approached with caution where seedbeds are dry. Ammonium toxicity is the major mechanism of germination and seedling damage when urea is the N source. With ammonium nitrate (which has a higher salt index than urea) excess salinity in the seed row is the major cause of germination and seedling damage. This salt effect will be more severe under dry than under moist conditions.

- With canola, ammonium nitrate is just a damaging to seedlings as urea.
- The N rates in the table are in addition to the N in safe rates of seed placed phosphorus fertilizer (monoammonium phosphate).

Soil Moisture Considerations

Seedbed moisture can rapidly decline after seeding depending on opener used, packing, residue, cover, weather, etc. Practices that conserve moisture in the seedbed are encouraged.

Where seedbed moisture is low or when the weather is conducive to fast drying of the seedbed (hot and windy), reduce the rates shown in the tables by at least 50 per cent.

Soil moisture and its effect on safe applications of seed placed N is a very complex issue. Rainfall immediately after seeding can reduce germination damage, particularly from urea. Urea is highly soluble in water. If enough rainfall is received a day or two after seeding (before the urea has been converted to ammonium) then the urea can be washed away from the seed and no damage will occur.

As seedbed conditions become drier, germination will be delayed even when no fertilizer is placed with the seed. A further delay in germination and emergence can occur when fertilizer is placed with the seed.

Figure 1. Approximate SBU-based safe rates of seed placed actual N (lb/ac.), as urea (46-0-0), for cereal grains, *if seedbed moisture is good to excellent* (seedbed moisture at or near field capacity).

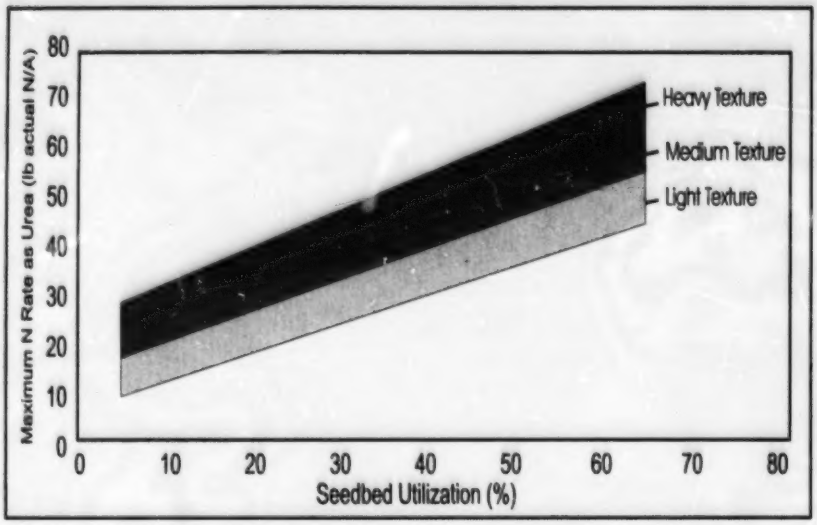

Figure 2. Wheat with 80 lb actual N/A as 46-0-0 with the seed (left) and side banded (right).

Photo courtesy of Les Henry

Nutrients are readily available to the developing seedling, yet the problems associated with seed placed fertilizer can be avoided, when seed and fertilizer are separated by 1 to 2 inches of soil. New and add-on equipment that allows fertilizer to be side banded or below banded is available. Also, although fertilizer efficiency may be reduced slightly in some situations, fertilizer can be deep banded prior to the seeding operation to avoid seed placed fertilizer injury.

Granular Nitrogen - Canola and Flax

The following are considered to be approximate safe rates of urea (46-0-0) N applications with the seed of canola and flax if seedbed soil moisture is good to excellent (*soil moisture at or near field capacity*).

All rates are in pounds actual N per acre (i.e. divided by 0.46 to get lbs. of 46-0-0 per acre)

Soil texture	1 inch spread [1] (Disc or knife) [2]			2 inch spread [1] (Spoon or hoe)			3 inch spread [1] (Sweep)		
	Row spacing			Row spacing			Row spacing		
	6"	9"	12"	6"	9"	12"	6"	9"	12"
	SBU [3]			SBU [3]			SBU [3]		
	17%	11%	8%	33%	22%	17%	50%	33%	25%
Light (sandy loam)	10	5	0	20	15	10	30	20	15
Medium (loam to clay loam)	15	10	5	30	20	15	40	30	20
Heavy (clay to heavy clay)	20	15	10	40	30	20	50	40	30

[1] *Width of spread* varies with air flow, soil type, moisture level, amount of residue and other soil conditions, so it must be checked under field conditions.

[2] Some openers give less than one inch spread.

[3] SBU (Seedbed Utilization) is the amount of the seedbed over which the fertilizer has been spread. Thus, it is a reflection of the relative concentration of fertilizer. SBU (per cent) is the *width of spread* divided by the row spacing multiplied by 100. For example, if the seeding implement has a six inch spacing and spread the seed and fertilizer over two inches, the SBU would be (two divided by six multiplied by 100 which equals) 33 per cent. The higher SBU, the more fertilizer that can safely be applied with the seed. Although some openers will also spread the seed and fertilizer vertically, SBU does not take this into account since it is generally recommended that all seed be placed at an even depth for even germination and emergence.

Additional notes:

- The N rates in the table are in addition to the N in safe rates of seed placed phosphorus fertilizer (monoammonium phosphate).
- Flax and canola are treated as a group in the above recommendations. Flax is slightly less tolerant than canola to seed placed N.
- For canola, ammonium nitrate is as damaging to seedlings as urea. There is no information available on the relative effect of ammonium nitrate versus urea on flax.
- Use the same Soil Moisture Considerations as outlined for cereal grains. When seedbed moisture is less than ideal reduce the rate of seed-placed fertilizer.

Anhydrous Ammonia

Anhydrous ammonia cannot be placed with the seed. However, in recent years there have been many individual modifications of equipment to allow anhydrous ammonia to be placed at seeding time in a band or other arrangement separated from the seed. The major consideration is to ensure that the anhydrous ammonia is separated from the seed by at least two to three inches. This separation should be below and to the side of the seed, or to the side of the seed. Anhydrous ammonia should not be applied directly below or above the seed. The anhydrous ammonia reaction zone with the soil is a pear-shaped zone. The anhydrous ammonia will tend to follow the furrow upward, so attempts at placing the anhydrous ammonia beneath the seed will likely lead to seed damage, and thus should be avoided.

Liquid Nitrogen

Liquid nitrogen (28-0-0) has half of the nitrogen in the urea-form and the other half in the form of ammonium nitrate. Safe rates of seed placed N as liquid nitrogen are only slightly higher than for urea. See the tables for the urea values.

Depending on the seeding equipment, producers **may** be able to safely increase N application (over the urea guidelines) by adjusting the tubes so the liquid fertilizer and seed are separated by soil. Safe rates will depend on the amount of separation and the soil, moisture and other agronomic considerations discussed in other sections of this bulletin. Safe rates will need to be determined by the producer on a by case basis.

Phosphorus

The main phosphorus fertilizer used in western Canada is monoammonium phosphate ($NH_4 H_2 PO_4$) with various analyses such as 12-51-0, 12-52-0 and similar numbers. Monoammonium phosphate has a low salt index and does not release much ammonium, so it has a relatively low toxicity to seedlings.

Maximum safe rates of actual seed placed phosphate (P_2O_5) fertilizer. (i.e. divide by 0.51 to get lbs. of 12-51-0 per acre)

Rates are based on disc or knife openers with a one inch spread, six to seven inch row spacing and good to excellent soil moisture	
Crop	**Actual P_2O_5(lb/A)**
Cereals	50
Canola	20
Flax	20
Faba bean	40
Lentil	20
Pea	15

CAUTION: The above recommendations are based on the fertilizer monoammonium phosphate. In areas near the U.S. border is not uncommon to have the fertilizer diammonium phosphate ($(NH_4)_2HPO_4$) available. Diammonium phosphate usually has an analysis of 18-46-0. Diammonium phosphate is much more toxic to seedlings than monoammonium phosphate and should be used with caution when placed with the seed.

Potassium

Where potassium fertilizer is placed with the seed use the phosphorus guidelines. The total pounds of phosphate (P_2O_5) plus pounds of potassium (K_2O) should not exceed the maximum safe rate of seed placed phosphate in the phosphorus table above. This applies under good to excellent moisture conditions.

Sulphur

Sulphate-sulphur is the plant available form of S and should be used to correct S deficiencies. When ammonium-sulphate fertilizer is placed with the seed, add the pounds of N from the ammonium-sulphate to the pounds of N from other nitrogen fertilizer being placed with the seed. The total N should not exceed the maximum safe rate of seed placed urea-N. See the nitrogen guideline tables for cereal and oilseeds in this fact sheet. This applies under good to excellent moisture conditions.

Other Agronomic Considerations

- Field variability in rolling land can affect results. Eroded knolls often have soils that are low in organic matter. These areas may show greater seedling damage from seed placed fertilizer.
- Seeding too deep, cloddy furrows, crusting, places more stress on seedlings and increases the likelihood of damage from seed placed fertilizer.
- Cold soil temperatures, disease, poor quality seed or high herbicide residue can delay emergence or weaken seedlings and thereby increase the probability of fertilizer damage to seedlings.
- Every effort should be made to ensure good seed-to-soil contact when seed placing fertilizer especially N.
- Wearing of openers can result in poor seed and fertilizer separation. Adjustments in the amount of fertilizer being added must be made as the openers wear.

This bulletin was revised by Ken Panchuk, Saskatchewan Agriculture and Food, with assistance from the members of the Saskatchewan Advisory Subcouncil on Soil Fertility

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